XIII. *Resting attitudes in some* Lepidoptera, *examples of recapitulation in habit.* By T. A. Chapman, M.D.

[Read October 4th, 1916.]

Plate LXXX.

A chance observation, recently, led me to make a few more that were available, and to the conclusion that the facts examined gave some indications of being instances of "recapitulation"; * that is, of a habit or structure of some ancestor, though now possibly useless, persisting and having a place earlier in the development of the individual than it had in the ancestor.

The resting attitude of the great mass of the *Heterocera* is with the wings in the same plane as that of the surface on which the insect is resting. Even so there is a good deal of variation, as, for example, in Noctuae there is the flat position with the wings crossed as in *Agrotis* and *Noctua*, or held in a pent-house position as in *Taeniocampa* (*Monima*) and *Plusia*.

As my observations were on Geometers it is more apposite to note that in them the usual position is with the wings laid flat on the surface, forming a triangle, the inner margins being parallel with the body, either against it or covering it. (Pl. LXXX, figs. 1 and 3.)

It is perhaps necessary to remember that, practically without exception, after leaving the pupa and expanding the wings, the *Lepidoptera* place the wings together vertically over the back (in the resting attitude adopted by butterflies), in the larger species with the wings hanging down, the insect resting on a vertical or overhanging object; so that gravity appears to be, and often is, necessary to keep the wings straight whilst hardening and drying.

* "Recapitulation" was the name given by Haeckel to the theory that the ontogeny of the individual presented briefly in series the evolution involved in the phylogeny. It thus applies properly to a succession of structures in the evolution, but one habit or structure exhibited temporarily in the ontogeny representing a final habit or structure in an ancestor would have to be classified under the same term. See Haeckel, "History of Creation" (Ray Lankester), i, p. 309.

In other species, not always very small, the insect may be on a horizontal surface; but the wings are held up vertically, and seem stiff enough to maintain this attitude during drying.

When the wings are dry and stiff this attitude is left, and the wings take the resting position normal to the species. What I have observed is, that this is not a strictly correct statement of what occurs in certain species, but that, by way of "recapitulation," the wings are deflexed to the position characteristic of the group (family ?) to which it belongs, and later assume that belonging to the species itself. I noticed this fact in the case of *Acidalia virgularia* (*Eois incanaria*). So soon as the wings are dry, in the attitude with them closed dorsally, they are brought down to the surface on which the insect is resting, to the normal Geometrid attitude, with the inner margins of the wings parallel to the body. This position is maintained for a varying period, apparently so long as the insect remains undisturbed; in one instance, I noted as long as three hours and three-quarters, and it may be they often remain so till the evening flight. But if disturbed, the insect runs or flies, even as little sometimes as, say, half an inch, but settles down with the wing in the Acidalian position, viz. with the fore-wings well forward, showing a good portion of the hind-wing. This occurs even if the disturbance is only a few minutes after the wings are deflexed, and in no case is the Geometrid attitude afterwards assumed. The explanation that this was a case of "recapitulation" seemed quite probable; if it were so, then it might be observed in some other species. Unfortunately material for making further observations was not abundant, and, for instance, it did not occur to me, in time, to secure some pupae of *Smerinthus*, though I have a dim recollection, but no notes to say whether this is reliable or the contrary, that the position with the hind-wings well forward, in this and in some Lasiocampids, is not assumed till some time after the wings are dry. I had, however, several species of *Ephyra* (*Leucopthalmia*), and found that their habit in this matter was precisely the same as in *E. incanaria*. I also had pupae of *Selenia bilunaria*, which seemed to be a desirable species to observe, as its resting attitude is that of the butterflies, and therefore less like the ordinary Geometrid position than that of the *Acidalias*. I found that, in *bilunaria*,

when the drying attitude is left, the wings are deflexed, but not to a flat position, they are still raised so as to make, between the two sides, an angle of from about 110° to 150°, apparently according to whether gravity, in the position in which the insect happens to be, tends to make them more or less open. This attitude is maintained for something less than an hour; in various instances on touching the wings to ascertain whether they were still soft and this was still a drying position, the disturbance made the insect assume the butterfly attitude; in every case the wings were found to be quite firm. In this species the resting attitude is very different from the usual Geometrid one and is identical with the drying position, so that one would suppose that the one might very properly be continued into the other; but a close approximation to the Geometrid attitude is assumed in passing from the one to the other. In a few cases I thought it was omitted, but was never sure that I had not missed it, or that it was shortened or left out owing to some disturbance.

It may be observed that the intermediate attitude here is very close to the resting attitude of *Selenia tetralunaria*, but has the wings slightly more deflexed.

In dealing with the *Rhopalocera*, I may say that I observed carefully and in some numbers only three species, *Pieris rapae*, *Vanessa urticae* and *Thecla quercus*; this is no doubt a rather narrow basis, but for facility of description I assume that they are fairly representative.

It seemed desirable, opportunity offering, to consider the butterflies. In these the resting attitude is identical with that for drying the wings, viz. the erect dorsal one. I do not know that there is any exception to this rule, if we except the *Hesperidae*, some of which rest with the wings deflexed, and the *Erycinidae*, at least the South American species or most of them. These are not, however, in the ancestry of our palaearctic butterflies; some Papilios are also known to rest with deflexed wings. The butterflies who adopt the "butterfly attitude" have cryptic undersides; those, like the Erycinids, that do not, have undersides not very different from the upper. The whole butterfly ancestry of the species I observed may be assumed to have used the "butterfly attitude" of rest.*

Therefore, unlike the Geometers referred to, which had

* I am indebted to Commander Walker and Mr. Kaye for reminding me of the Erycinid attitude.

a comparatively recent ancestry with deflexed wings, we have here to go back to the Skippers, or possibly the *Castnias*, for such ancestors, and one would regard it as probable that any memory of a deflexed position of rest had been entirely lost. Possibly this is so, yet in the process of expanding, or rather of drying the wings after expansion is completed, there is a phase, that does not seem to occur in the *Heterocera*, that strongly suggests that some reminiscence of the deflexed attitude still exists, but has been pushed backwards from the point just following drying, till it has become involved in the period of drying. In any case, whether it admits of this interpretation or not, this difference of procedure is obviously of interest, and seems to require some explanation. In butterflies, the wings are expanded, as indeed in most *Heterocera*, in approximately the resting attitude, but, when expanded, are definitely placed in the drying position, all nearly parallel, hind-wings close against fore-wings, but the fore-wings only touching at their tips and hind margins. Then begins the special butterfly process: after a few minutes the wings are separated, to such a degree that were they stiff the upper surfaces of the opposite wings would be at an angle of 90° at least with each other, but being limp the wings hang in somewhat bell-shaped fashion, as observed on the costal aspect. They are retained here for some thirty seconds, and again closed; they are then opened and closed, each phase occupying about half a minute, but varying a little, for some six to ten times, the wings gradually stiffening, not being opened so wide, and so losing the bell-form, the wings being nearly straight. In the last open positions the hind-wings separate from the fore-wings, so that there is an interval of a full millimetre between each adjacent pair of wings; finally the wings are closed, so that rather more than the tips touch, and very gradually are more closely approximated, so that the costae coincide for fully two-thirds of their length. This is the assumption of the true resting attitude; no further change of position occurs until the insect is disturbed, or takes flight, etc. This description refers more particularly to *Pieris rapae*, than to the other species observed.

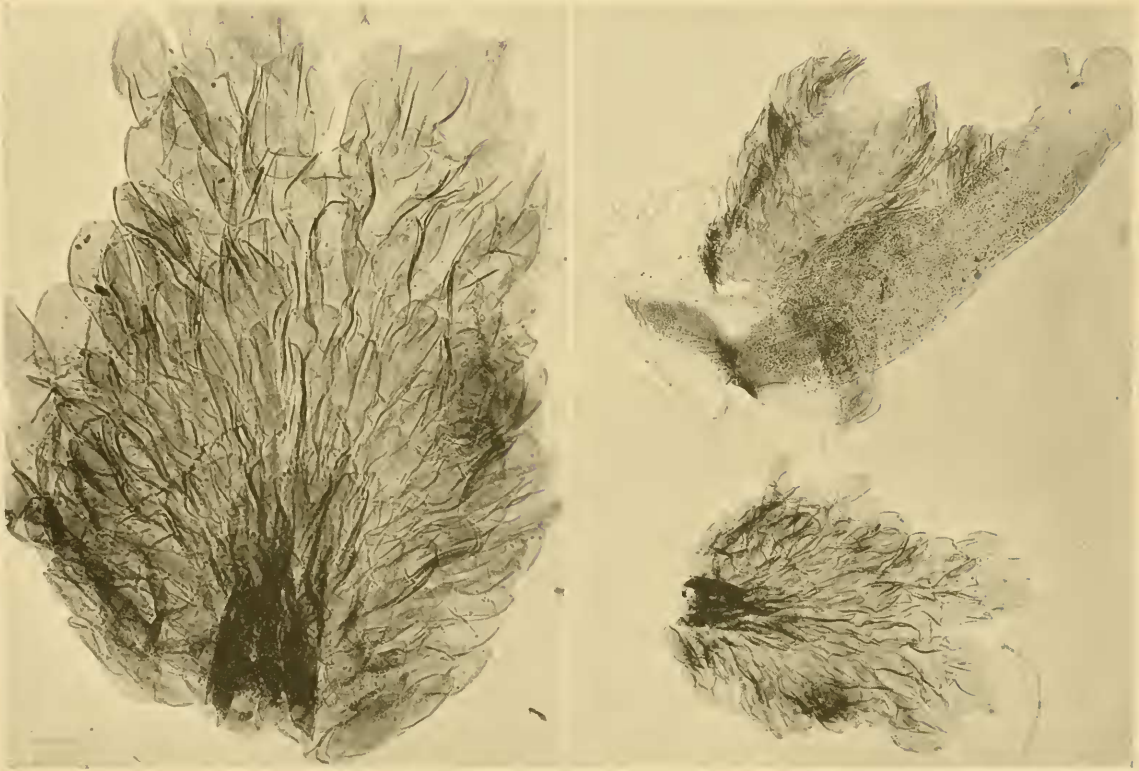
This is a very different process from the typical Heterocerous one of suddenly throwing the wings back, keeping them there immovably till they are dry, and suddenly

Photo, A. E. Tonge.

TWO SPECIMENS OF A. THETIS, WITH REIN EXTENDED AND CLOTHED IN SHEATH × 10.

Photo, F. N. Clark. *Photo, A. E. Tonge.*

REIN-SHEATH OF A. BELLARGUS, ***in situ***, AND OF A. CORIDON, SEPARATED.



Photo, F. N. Clark.

REIN AND SHEATH (BROKEN ACROSS) OF P. ICARUS × 25, AND LOWER PORTION × 70

Photo, F. N. Clark.

PORTIONS OF BROKEN-UP REIN-SHEATH OF A. CORIDON × 35 and × 100.

SCALES OF REIN-SHEATH OF A. CORIDON × 200.

Photo, F. N. Clark.